CHARLES UNIVERSITY IN PRAGUE
Faculty of Physical Education and Sport
Department of Physiotherapy

Physiotherapy record of patient with Gonarthrosis

Bachelor thesis

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Declaration:

I declare that this Bachelor Thesis has been based entirely on my own individual work and on my own practice that took place in Vojenska Nemocnice in Prague from 9/2/2009 till 20/2/2009. All the information used for the development of this Bachelor Thesis has been taken from the list of literature that exists in the end of this Thesis.

In Prague 04.04.2009

Spyrellis Charilaos

Acknowledgement

First of all I would like to thank my mother, an incredible person and also an idol for me. She really helped me a lot and supported all of my decisions which one of these was to come and study to Prague. She is the light in my soul and the person that I love most in the world.

After that I wanted to thank all of my professors for the knowledge and for giving me the ability to complete this bachelor thesis. Special thanks I would like to give to my supervisor in my bachelor thesis Doc. Dagmar Pavlu and my supervisor in my clinical practice Dis Jindriska Sverakova.

Abstract

Title: Physiotherapy record of patient with Gonarthrosis

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Aim: In this thesis Therapeutic approach in Gonarthrosis will be discussed and complete physiotherapeutic record during 2 weeks of rehabilitation.

Methods: I worked with the patient for 8 sessions, every day for one hour. Therapy included soft tissue techniques for edema and scar, strengthening exercises with over ball, Thera band and PNF for weak muscles. Also PIR and PFS for shortened or hyper tonus muscles and sensory motor stimulation (short foot). Mobilization was included for blockage of patella and sensory motor stimulation for better stability of the knee.

Results: After 8 session with the patient every day for 1 hour the results were obvious and successful. Edema was decreased and ROM increased. Coordination of muscles improved after MRT techniques and strengthening exercises with over ball, PNF and Thera band and this is obvious from patient's posture at final kinesiologic examination and the correct performance of basic moving stereotypes. Mobilization of patella removed the blockage successfully. At last sensory motor stimulation improved stability of the knee.

Key words: Gonarthrosis, physiotherapy

Contents:

1. Preface

When I was young I was playing basketball and had many injuries, as a result to visit very often physiotherapists. First time that I visited a physiotherapist was when I was 15. During a play I fractured my ankle joint, my mother took me to the hospital where they put me cast to all my leg, from hip to foot and told me to hold for 20 days. Because I had to go to school and it was very difficult with the cast we had to find another solution. So we went to a physiotherapist. He immediately removed the cast and started with exercises and physical therapy to treat my ankle joint. In 5 days I was able to play again without any problem. It was then that I decided I want to be physiotherapist.

In this bachelor thesis my main goal is to analyze my therapeutic approach in patients who suffer from Gonarthrosis. Gonarthrosis is chronic wear of the cartilage in the knee joint. It is a common disease and it was very interesting for me because I could use many things that I learned during my studies here.

This Thesis describes my two-week practice, which was elaborated at the Vojenska Nemocnice.

2. General Part

2.1 Knee joint anatomy

2.1.1 Bones and joints

The knee joint is the largest synovial joint in the body. (Fig. 1) It consists of:

- The articulation between the femur and tibia, which is weight bearing.
- The articulation between the patella and the femur, which allows the pull of the quadriceps femoris muscle to be directed anteriorly over the knee to the tibia without tendon wear.

Two fibrocartilaginous menisci, one on each side, between the femoral condyles and tibia accommodate changes in the shape of the articular surfaces during joint movements.

The detailed movements of the knee joint are complex, but basically the joint is a hinge joint that allows mainly flexion and extension. Like all hinge joints, the knee joint is reinforced by collateral ligaments, one on each side of the joint. In addition, two very strong ligaments (the cruciate ligaments) interconnect the adjacent ends of the femur and tibia and maintain their opposed positions during movement.

Because the knee joint is involved in weight bearing, it has an efficient 'locking' mechanism to reduce the amount of muscle energy required to keep the joint extended when standing.

The articular surfaces

The articular surfaces of the bones that contribute to the knee joint are covered by hyaline cartilage. The major surfaces involved include:

- The two femoral condyles;
- The adjacent surfaces of the superior aspect of the tibial condyles.

The surfaces of the femoral condyles that articulate with the tibia in flexion of the knee are curved or round whereas the surfaces that articulate in full extension are flat.

The articular surfaces between the femur and patella are the V-shaped trench on the anterior surface of the distal end of the femur where the two condyles join and the adjacent surfaces on the posterior aspect of the patella. The joint surfaces are all enclosed within a single articular cavity, as are the intra-articular menisci between the femoral and tibial condyles.

Menisci

There are two menisci, which are fibrocartilaginous C-shaped cartilages, in the knee joint, one medial (medial meniscus) and the other lateral (lateral meniscus) . Both are attached at each end to facets in the intercondylar region of the tibial plateau.

The medial meniscus is attached around its margin to the capsule of the joint and to the tibial collateral ligament whereas the lateral meniscus is unattached to the capsule. Therefore, the lateral meniscus is more mobile than the medial meniscus.

The menisci are interconnected anteriorly by a transverse ligament of the knee. The lateral meniscus is also connected to the tendon of the popliteus muscle, which passes superolaterally between this meniscus and the capsule to insert on the femur. (6)

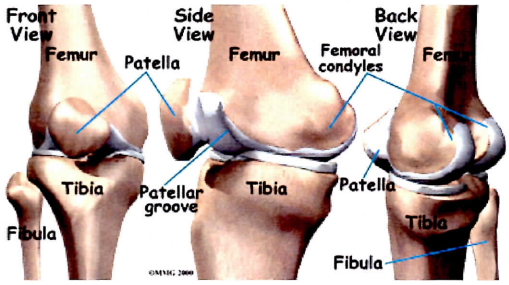

Figure 1: Bones of knee joint (19)

The menisci improve congruency between the femoral and tibial condyles during joint movements where the surfaces of the femoral condyles articulating with the tibial plateau change from small curved surfaces in flexion to large flat surfaces in extension. (6)

2.1.2 Ligaments and tendons

Ligaments are tough bands of tissue that connect the ends of bones together. Two important ligaments are found on either side of the knee joint. They are the *medial collateral ligament* (MCL) and the *lateral collateral ligament* (LCL).

Inside the knee joint, two other important ligaments stretch between the femur and the tibia: the anterior cruciate ligament (ACL) in front, and the posterior cruciate ligament (PCL) in back.

Collateral ligaments

The collateral ligaments, one on each side of the joint, stabilize the hinge-like motion of the knee.

The cord-like fibular collateral ligament is attached superiorly to the lateral femoral epicondyle just above the groove for the popliteus tendon. Inferiorly, it is attached to a depression on the lateral surface of the fibular head. It is separated from the fibrous membrane by a bursa.

The broad and flat tibial collateral ligament is attached by much of its deep surface to the underlying fibrous membrane. It is anchored superiorly to the medial femoral epicondyle just inferior to the adductor tubercle and descends anteriorly to attach to the medial margin and medial surface of the tibia above and behind the attachment of sartorius, gracilis, and semitendinosus tendons. (6)

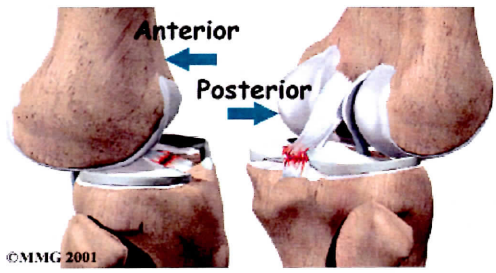

Figure 2: Ligaments of knee joint (19)

Cruciate ligaments

The two cruciate ligaments are in the intercondylar region of the knee and interconnect the femur and tibia. (Fig. 2) They are termed 'cruciate' (Latin for shaped like a cross) because they cross each other in the sagittal plane between their femoral and tibial attachments:

- The anterior cruciate ligament is attached to the depression in front of the intercondyloid eminence of the tibia, being blended with the anterior extremity of the lateral meniscus, it passes upward, backward, and lateralward, and is fixed into the medial and back part of the lateral condyle of the femur.
- The posterior cruciate ligament is stronger, but shorter and less oblique in its direction, than the anterior. It is attached to the posterior intercondyloid fossa of the tibia, and to the posterior extremity of the lateral meniscus and passes upward, forward, and medialward, to be fixed into the lateral and front part of the medial condyle of the femur.

The anterior cruciate ligament crosses lateral to the posterior cruciate ligament as they pass through the intercondylar region.

The anterior cruciate ligament prevents anterior displacement of the tibia relative to the femur and the posterior cruciate ligament restricts posterior displacement (6, 8).

Tendons are similar to ligaments, except that tendons attach muscles to bones. The largest tendon around the knee is the patellar tendon. This tendon connects the patella (kneecap) to the tibia. This tendon covers the patella and continues up the thigh.

There it is called the quadriceps tendon since it attaches to the quadriceps muscles in the front of the thigh. The hamstring muscles on the back of the leg also have tendons that attach in different places around the knee joint. These tendons are sometimes used as tendon grafts to replace torn ligaments in the knee. (6)

2.1.3 Muscles of knee joint

Quadriceps

The quadriceps femoris is the extensor of the knee. It is a powerful muscle, three times stronger than all the knee flexors together, and it has to be, as it singled-handedly prevents us from falling down from an erect position, as long as the knee is in a position of flexion. When we are in a position of 0° knee E or more, the quadriceps does not have to be active for us to maintain that position. The patella's main function is to increase the effectivity of the quadriceps, as it shifts the fulcrum of pull more anteriorly.

The quadriceps femoris, as its name implies, comprise four separate muscle bellies, the rectus femoris, the vastus medialis, the vastus intermedius and the vastus lateralis.

The three vastii are all acting over only one joint, and cause only extension. However, the vastus medialis is more active on an externally rotated limb, or if

performing external rotation and knee extension simultaneously, while the vastus lateralis is more active on an internally rotated limb or if knee extension is accompanied by internal rotation.

The vastus medialis should be more powerful than the vastus lateralis to prevent the patella from dislocating laterally.

The rectus femoris acts over both the hip, where it does flexion, and over the knee where it does extension. However, it provides only one fifth of the total power of knee extension. Its efficiency as a knee extensor depends on the amount of hip F; the less hip F, the more efficient it is at extending the knee. Conversely, the more knee F, the more efficient it is at producing flexion at the hip.

The flexors of the knee are primarily the hamstrings - semitendinosus, semimembranosus and the short and long head of biceps femoris - and secondarily the gracilis, sartorius and popliteus, and thirdly the two heads of gastrocnemius. (6)

Hamstrings

There are three long muscles in the posterior compartment of the thigh: biceps femoris, semitendinosus, and semimembranosus -and they are collectively known as the 'hamstrings' . All except the short head of biceps femoris cross both the hip and knee joints. As a group, the hamstrings flex the leg at the knee joint and extend the thigh at the hip joint. They are also rotators at both joints.

Biceps femoris :

The biceps femoris muscle is lateral in the posterior compartment of the thigh and has two heads:

- The long head originates with the semitendinosus muscle from the inferomedial part of the upper area of the ischial tuberosity;
- The short head arises from the lateral lip of the linea aspera on the shaft of the femur.

The muscle belly of the long head crosses the posterior thigh obliquely from medial to lateral and is joined by the short head distally. Together, fibers from the two heads form a tendon, which is palpable on the lateral side of the distal thigh. The main part of the tendon inserts into the lateral surface of the head of the fibula. Extensions from the tendon blend with the fibular collateral ligament and with ligaments associated with the lateral side of the knee joint.

Biceps femoris flexes the leg at the knee joint. The long head also extends and laterally rotates the hip. When the knee is partly flexed, the biceps femoris can laterally rotate the leg at the knee joint.

The long head is innervated by the tibial division of the sciatic nerve and the short head is innervated by the common fibular division of the sciatic nerve.

Semitendinosus :

The semitendinosus muscle is medial to the biceps femoris muscle in the posterior compartment of thigh . It originates with the long head of the biceps femoris muscle from the inferomedial part of the upper area of the ischial tuberosity. The spindle-shaped muscle belly ends in the lower half of the thigh and forms a long cord-like tendon, which lies on the semimembranosus muscle and descends to the knee. The tendon curves around the medial condyle of the tibia and inserts into the medial surface of the tibia just posterior to the tendons of the gracilis and sartorius muscles.

Semitendinosus flexes the leg at the knee joint and extends the thigh at the hip

joint. Working with semimembranosus, it also medially rotates the thigh at the hip joint and medially rotates the leg at the knee joint.

The semitendinosus muscle is innervated by the tibial division of the sciatic nerve.

Semimembranosus:

The semimembranosus muscle lies deep to the semitendinosus muscle in the posterior compartment of thigh . It is attached above to the superolateral impression on the ischial tuberosity and below mainly to the groove and adjacent bone on the medial and posterior surfaces of the medial tibial condyle. Expansions from the tendon also insert into and contribute to the formation of ligaments and fascia around the knee joint.

Semimembranosus flexes the leg at the knee joint and extends the thigh at the hip joint. Working with the semitendinosus muscle, it medially rotates the thigh at the hip joint and the leg at the knee joint.

The semimembranosus muscle is innervated by the tibial division of the sciatic nerve. (2 , 6, 10)

Sartorius

The sartorius is primarily a flexor, abductor and lateral rotator of the hip, but it also function as a flexor of the knee, which is why it is often short in patients after knee surgery. Sartorius muscle is the most superficial muscle in the anterior compartment of thigh and is a long strap-like muscle that descends obliquely through the thigh from the anterior superior iliac spine to the medial surface of the proximal shaft of the tibia. Its flat aponeurotic insertion into the tibia is immediately anterior to the insertion of the gracilis and semitendinosus muscles. (6)

Gracilis

The **gracilis** produce adduction and flexion at the hip, and flexion and medial rotation of the knee. Is the most superficial of the muscles in the medial compartment of thigh and descends almost vertically down the medial side of the thigh. It is attached above to the outer surface of the ischiopubic ramus of the pelvic bone and below to the medial surface of the proximal shaft of the tibia, where it lies sandwiched between the tendon of sartorius in front and the tendon of the semitendinosus behind. (6)

Gastrocnemius

The **gastrocnemius** is practically a useless flexor of the knee, but it is nevertheless a powerful stabilizer of the knee. As it contracts in the early phases of walking, when the knee extends and the ankle plantar flexes, it forces the femoral condyles anteriorly on the tibia, acting as an antagonist-synergist to the quadriceps femoris.

The flexors are at the same time rotators of the knee. Those attached lateral to the vertical axis of rotation are lateral rotators, while those attached to the vertical axis of rotation are medial rotators.

The medial rotators comprise the sartorius, semitendinosus, semimembranosus, gracilis and popliteus. The act as a brake on lateral rotation on a flexed knee, and thus protect the capsule and ligaments when the knee is violently subjected to lateral rotation.

The lateral rotators comprise the biceps femoris and tensor fasciae latae. The tensor fasciae latae acts as a lateral rotator and flexor on an already flexed knee. As soon as the knee reaches the position of reference, it loses its ability to rotate and flex, and keeps the knee in extension.

Together, medial rotation and extension of the knee tightens all ligaments of the knee, thus enabling the knee joint to maintaining erect posture all by itself,

without the aid of muscles. This is in other words, the least energy expending posture. (2, 6, 10)

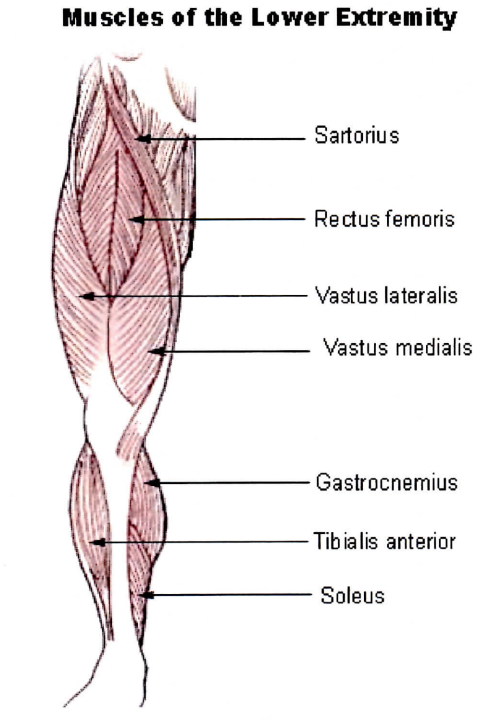

Figure 3: Anterior muscles of leg (21)

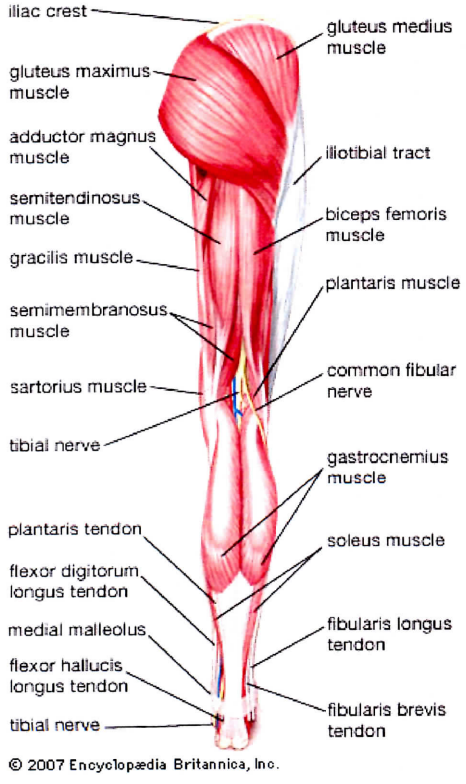

Figure 4: Posterior muscles of leg (20)

2.1.4 Nerves

The most important nerve around the knee is the popliteal nerve in the back of the knee. This large nerve travels to the lower leg and foot, supplying sensation and muscle control. The nerve splits just above the knee to form the tibial nerve and the peroneal nerve. The tibial nerve continues down the back of the leg while the peroneal nerve travels around the outside of the knee and down the front of the leg to the foot. Both of these nerves can be damaged by injuries around the knee. (19)

2.2 What is Gonarthrosis (knee osteoarthritis)

Gonarthrosis or osteoarthritis (OA) of the knee can be the result of natural degeneration of the menisci and/or the articular cartilage, the consequence of repeated micro trauma (either occupational or sport related), or secondary to injuries, such as a ruptured anterior cruciate ligament (which is particular lyarthrogenic).

While the lesions may be either meniscal or cartilaginous in origin, the modality and the rapidity of degradation of the cartilaginous structures depend largely on local mechanisms. This degradation can occur very slowly or extremely quickly in the form of an acute flare, with an alteration in the phases of stabilization and chondrolysis.

The synovial membrane intervenes in this process of degradation, by the production of intermediary substances such as cytokines and metalloprotinases, many of which are destructive to the cartilage.

The therapeutic options at our disposal are numerous, and are aimed principally at the degenerating cartilage. They must be prescribed in accordance with the age of the patient, his functional discomfort and degree of pain, with consideration also given to the stage and to the speed of evolution of the degenerative process.

In general, the two principal objectives of management are to provide effective analgesia and, if possible, to preserve the remaining cartilage. In circumstances where these objectives are not achieved, the option of surgical intervention must be considered.

Among the plethora of medical treatment options which exist, there are those that have been in use for a long time and are well established, and others which are relatively recent and are still undergoing evaluation. (4)

2.2.1 Causes of Gonarthrosis

Deterioration of articular cartilage is the main problem associated with knee osteoarthritis (gonarthrosis). The condition can be caused by:

- Previous knee injury
- Repetitive strain on the knee
- Fractures, ligament tear, and meniscal injury which can affect alignment and promote wear and tear
- Genetics which make some people more likely to develop knee osteoarthritis
- Obesity
- Problems with subchondral bone (the bone layer underneath cartilage). (7, 14)

2.2.2 Diagnosis of Gonarthrosis

Medical history, physical examination, and x-rays are used to diagnose knee osteoarthritis (gonarthrosis). X-rays are very helpful, allowing the doctor to see evidence of joint space narrowing and rule out other causes of knee pain. If more detailed imaging is needed, an MRI may be ordered. Arthroscopic knee surgery is another way to view the condition of the knee. The pain of osteoarthritis is usually related to activity. For osteoarthritis of the knee, activities such as climbing stairs, getting out of a chair, and walking long distances bring on pain. Morning stiffness usually lasts less than 30 minutes. Patients often note that their knees "give way," a so-called instability symptom. (7, 14)

2.2.3 Symptoms of Gonarthrosis

Knee osteoarthritis (gonarthrosis) typically develops gradually over a period of years. The primary symptoms associated with knee osteoarthritis include:

- pain (mild, moderate, or severe)
- stiffness
- limited range of motion in the knee
- localized swelling

Knee osteoarthritis pain is usually worse following activity, especially overuse of the affected knee. Stiffness can worsen after sitting for prolonged periods of time. As knee osteoarthritis progresses, symptoms generally become more severe. Pain can become continuous rather than only when weight-bearing. (7, 14)

2.2.4 Treatment of Gonarthrosis

Before considering therapeutic options in an individual with OA of the knee, the physician must be certain that the patient's knee pain is indeed attributable to OA. For instance, it is not infrequent for an individual with a periarticular disorder such as anserine, infrapatellar, or prepatellar bursitis to be treated erroneously for knee OA. In some patients with disorders of the spine and hip, pain can be referred to the knee.

Therefore, it is essential that OA of the knee be established as the basis for the patient's signs and symptoms before beginning therapy. (9)

No pharmacologic therapy

- Patient education
- Self management programs (e.g., Arthritis Self-Help Course)
- Weight loss (if overweight)
- Physical therapy
- Range of motion exercises
- Quadriceps strengthening exercises
- Occupational therapy
- Joint protection and energy conservation
- Assistive devices for ADLs
- Aerobic exercise programs

The components of no pharmacologic therapy and the central role of the physical therapist in the management of patients with OA of the knee (gonarthrosis) are identical to those used in patients with OA of the hip. The

role of exercise in the management of OA of the knee is very important. Strengthening of quadriceps musculature with either isometric or isotonic, resistive exercises were associated with significant improvement in quadriceps strength, knee pain, and function, when compared with controls. If the patient cannot participate in an organized exercise program, the primary care physician should ensure that all patients with OA of the knee are instructed in quadriceps strengthening exercises.

Proper use of a cane (in the hand contra lateral to the affected knee) reduces loading forces on the joint and is associated with decreased pain and improved function. In addition, patients may benefit from shoe inserts to correct abnormal biomechanics due to angular deformities of the knees. Although no trial data are available, the wearing of shock-absorbing shoes with insoles is believed to be of benefit. Another useful maneuver for patients with OA of the knee who have symptomatic patellofemoral compartment involvement is medial taping of the patella. Finally, the use of light-weight knee braces may also be helpful in patients with tibiofemoral disease, especially if complicated by lateral instability.

Aerobic conditioning exercises have been found to be feasible and efficacious in individuals with OA of the knee. In addition, a supervised fitness walking program combined with patient education was shown to be of benefit in patients with knee OA. A program of aerobic activity, particularly an aquatic program such as that sponsored by the Arthritis Foundation, should be suggested to all patients with OA of the knee to improve functional status and reduce pain. These exercise programs, however, require a commitment of time and effort on the part of the patient.

Several epidemiologic studies have found that obesity is a major risk factor for the development and progression of knee OA, and, in one study, weight loss was associated with lower odds of developing symptomatic knee OA in women. Whether weight loss will slow the progression of or alleviate symptoms in

patients with existing OA of the knee is not known. Nonetheless, overweight patients with OA of the knee, especially if they are being considered as candidates for total knee arthroplasty should be encouraged to participate in a comprehensive weight management program including dietary counseling and aerobic exercise. Specific dietary therapy and other unproven therapies are not recommended in the management of patients with OA of the knee. (9)

Pharmacologic therapy

- Intraarticular steroid injections
- Non-opioid analgesics (e.g., acetaminophen)
- Topical analgesics (e.g., capsaicin and methylsalicylate creams)
- Nonsteroid anti-inflammatory drugs
- Opioid analgesics (e.g., propoxyphene, codeine, oxycodone) (9)

Surgical treatment

There are several different types of surgical interventions.

- **Arthroscopy**: The surgeon makes a small incision in the skin and places a small tube through which he can examine the joint and perform procedures such as scraping cartilage or bone and repairing ligaments. Arthroscopy can be helpful if your joint pain results from a tear in the cartilage or meniscus, or if bits of debris are causing problems with bending or straightening the joint. In people younger than 55 years, arthroscopic surgery may help delay the need for more serious surgery, such as a joint replacement. As with any surgery, there are some risks with arthroscopy due to the use of anesthesia and the possibility of infection. Other complications include damage to nerves or blood vessels, the development of blood clots in veins, and scarring. (1, 5)

- **Osteotomy**: In an osteotomy the surgeon will remove part of the bone in a joint to realign the joint as a temporary treatment for osteoarthritis. An osteotomy can restore knee function and diminish osteoarthritis pain. It may even stimulate the growth of new cartilage. Although an osteotomy can decrease pain and improve function, the results often deteriorate over the long term. Many people who have an osteotomy will eventually need a total knee replacement (arthroplasty).

  As with all surgeries, there is a slight possibility of infection, complications from the anesthesia, or other surgical complications, such as blood clots, nerve damage, and circulation problems. There will be a cosmetic difference between the surgically treated knee and the untreated knee. (1, 5)

- **Arthroplasty/Joint Replacement**: In arthroplasty, the surgeon removes part of the bone and replaces the joint with a man-made joint. These man-made joints are ever improving and can last many years. The results of total joint replacement are generally excellent. Patients experience significant pain relief and improved physical functioning. There are some risks to the surgery, and full rehabilitation may take 3 to 6 months. In addition, the prosthesis (artificial joint) may eventually loosen or wear out so that a second surgery is needed. However, at the 10-year mark, the success rate with most prostheses today is about 90%. (1, 5)

- **Chondrotissue:**

  Is used in micro fracturing and Pridie drilling to induce hemostasis and protect the underlying tissue in degenerative and traumatic lesions of articular cartilage. (1, 5)

2.3 Chondrotissue transplantation

The concept of a cell-free regenerative approach for articular cartilage repair was introduced in 2005. A matrix consisting of Collagen I/III was used to treat local cartilage defects in the knee joint after micro fracture. A new implant is used, which covers and therefore protects the subchondral bone after micro fracture. Additionally, it may improve cartilage tissue regeneration by recruitment of mesenchymal stem cells (MSC) from the subchondral bone as described recently in an animal study in sheep. Hegewald et al described the positive effect of hyaluronan on the chondrogenic differentiation of MSC in three-dimensional culture in vitro. The implant was fixed using bioresorbable pins, which ensured secure fixation. Other fixation techniques e.g. conventional suturing might not be stable enough to withstand the load and shear stress, which occurs in a knee joint.

This suggests that implantation of chondrotissue and a secure pin fixation improves the micro fracture technique. (16)

To restore the elastic properties it is recommended to mix chondrotissue® with human serum before implantation. For this purpose, about 9 ml blood should be drawn from the patient before the arthroscopy. Then centrifuge the blood 10 minutes or leave to stand at room temperature for about 30 minutes until the blood clot has settled.

After debridement, the defect should be measured and the subchondral bone perforated with an awl at a distance of about 3 - 5 mm during arthroscopy.

Chondrotissue® can be fixed in the defect employing commonly used orthopedic fixation methods, e.g.:

- Fibrin glue: fibrin glue applied to the edges of the chondrotissue® previously placed in the defect and distribute it evenly
- Bioresortable pins
- Transosseus fixation
- Cartilage suture

Expected Results: 6 month after surgery, the patient is free of pain and discomfort. (3)

2.4 Physiotherapy and Gonarthrosis

Therapy of osteoarthritis of the knee is aimed at relieving pain and changing behavior patterns, which usually leads to reduced activity. The weakening of the quadriceps musculature leads to an increase in both joint instability and arthritis. Walking time is prolonged and the pain-induced reaction of knee angle velocity is onset by increased stress on other joints. The progressive muscle atrophy correlates to the degree of pain. Overuse and pain can be avoided by precise and low-dose strength training. Objective and reproducible measurements in the patients are essential to make individual training possible. (2)

Strengthening Exercises

Because patients with gonarthrosis have weakness of lower limb muscles, particularly the quadriceps and because these muscles assist in attenuating potentially injurious impact loading at the knee, lower limb strengthening is generally included as a treatment for this condition. There is substantial evidence to support the use of progressive strength training. Patients can do exercises either sitting or standing. (2)

Sitting exercises:

- Knee raise: Sit up with both feet resting on the floor. Raise one knee so that foot rises 10 cm from the floor. Hold 5-10 seconds and then relax. 5 repetitions for each leg

- Kick back: Patient bend knee so that the foot moves backwards under the chair. Hold there for 5-10 sec and then relax. 5 repetitions.
- Leg raise: Patient raise foot until leg is straight as possible. Hold there and slowly lower the foot to the floor. Than the other leg.
- Push back: Patient place feet on the floor with the back of his left heel against the left front leg of the chair. He pushes back against the chair leg with his left foot. Hold for 5 seconds and then relax. 5 repetitions. (18)

Standing exercises:

- March: Patient raises his left foot from the ground by bending his knee as high as he can. He lowers the foot to the floor. He can perform this exercise for 2 minutes as if he was marching in place.
- Knee bends: Patient stands with his feet about one step apart. He places his hands on hips. Slightly he bend his knees and then straighten them
- Kick forward: Patient stand straight with his left hand on the back of a chair. He moves right leg forward. He must use only hip motion and must not bend the waist. Holds for 2-3 seconds and relax.10 repetitions.
- Kick back: Patient stand straight with both hands on the back of a chair. He moves his left leg back and holds it there for 2-3 seconds and then return leg to place. 10 repetitions. (18)

Lying exercises:

- Lie with a pillow under heel. Tighten the muscles on the top of the leg and try to push the knee toward the floor. Hold 5 seconds
- Bend one leg. Raise the other leg 6 inches with the knee locked, keeping the thigh muscles tight. Hold 5 seconds.

- Bend one leg. Grasp the other leg and slowly try to straighten the knee until a stretch is felt behind the knee. Hold 5 seconds.
- Bend both knees placing feet flat. Slowly raise buttocks from the floor, keeping stomach tight. Avoid arching the back. Hold 5 seconds.
- Lie on your stomach. Bring your heel toward the buttock. Patient can use the other leg to push gently. Hold 5 seconds. (18)

Physiotherapists can use exercises with over ball and Thera band for strengthening and also PNF techniques. For relaxation of shortened and hyper tonus muscles, PIR and MRT techniques can be used. If there is a scar, soft tissue techniques can be used for treatment. (13) Also studies have shown that physical therapy has a good effect, like pulsed ultrasound. (11)

A complete therapeutic program should include a combination of different types of workouts performed on a regular basis. Other activities like walking, swimming which is good cause does not load the knee and also static cycling would benefit a lot the condition of the patient. (2)

Exercises to avoid

In patients with osteoarthritis in knees avoid exercises that stress the knees, such as tennis. Also, avoid over exercising. Joint pain that lasts longer than 2 hours after exercise may be a sign of over exercising. Studies show that exercising harder does not necessarily lead to further improvement in osteoarthritis pain or ability to do daily activities, so exercise within patient's tolerance. If an activity makes patient feel sore, try something different. Patient also can change how he does the activity by trying any of the following:

- Rest between repetitions or between activities.
- Decrease speed.
- If walking or swimming, go a shorter distance. He may be able to take two or three short walks in a day rather than one long walk.
- Spend a shorter time exercising, then rest and do a little more lately.
- Lift less weight. (15)

Long term Physiotherapy:

The key principles are to:

- Build strength and endurance
- Maintain strength and endurance
- Balance the main muscle groups
- Maintain range of motion
- Improve knee stability
- Prevent further damage by optimizing weight and regaining full position sense in the knee.

3. Special Part

3.1 Anamnesis

Patient: J.D, 45 years old, male, married

Height: 1, 78 cm

Weight: 80 kg

Diagnosis: Gonarthrosis (right knee)

Personal anamnesis:

Childhood diseases: Common childhood diseases.

Previous operations: Arthroscopy of right knee menisci at May 2008.

Allergies: None.

Family: Father died at age 75 from heart attack.
Mother died at age 70 from cancer.
Has 2 daughters 14 and 10 years old.

Abuses: None

Hobbies: Ski, hokey, swimming, running, bicycle.

Social anamnesis:

Patients is football player (sal), he does 5 times per week training with the team and every Sunday they have a game.

He lives with his wife and his 2 daughters in apartment in 1st floor with elevator.

He has car.

Pharmacological anamnesis:

Condrosulf 800, he takes 1 tablet every morning.

Medical anamnesis:

Before 3 months pain in right knee started and he was diagnosed with Gonarthrosis. At 7.1.2009 he did surgery of chondrotissue (artificial cartilage) in right knee. He had to stay in rest for 2 weeks and then started physiotherapy in Vojencka Nemocnice.

Previous physiotherapy:

5 sessions since 5 February 2009 doing mostly scar tissue treatment, strengthening exercises for leg muscles and swimming exercises.

Doctor medical documentation:

No documentation.

Patient must walk with crunches for approximately 2 months.

Present status:

Patient now has a little pain in right knee and mostly during extension movement. Generally he doesn't feel pain, he sleeps well at night but he feels his leg "heavy". Stitches are off and there is scar. Patient now walking with crunches as he must not load the knee. Operated knee has edema and it is swollen.

3.2 Initial kinesiologic examination (11-2-2009)

3.2.1 Posture evaluation

Table 1. Frontal view

Transversal arch	Flat (both feet)
Longitudinal arch	Normal (both feet)
Feet	External rotation (both feet)
Calf	Symmetrical
Knee Patella	Varosity (both knees) External rotation: positive (both knees)
Thigh contour	Symmetrical
Anterior superior iliac spines	Symmetrical
Umbilicus	Middle line
Nipples	Right is lower
Hands	Pronation(both hands)
Clavicles	Right is lower
Shoulders	Right is lower(dominant hand is right)
Head position	Lateral flexion to the right Rotation to the right

Breathing type:

Upper chest breathing.

Table 2. Side view

Ankle joints	Plantar flexion(both sides)
Knee joints	Right in semi flexion Left in hyperextension
Pelvis position	Posterior tilt
Lumbar spine	Flat
Thoracic spine	Flexed (kyphosis)
Cervical spine	Slight extension
Head position	Protraction

Table 3. Posterior view

Heel form	Square shape(both sides)
Achilles tendon contour	Symmetrical
Base of feet	Wide base
Calf	Symmetrical(both sides)
Knee joints	Varosity(both sides)
Subgluteal lines	Symmetrical
Iliac crests	Symmetrical
Posterior superior iliac spines	Symmetrical
Scapulas	Right scapula is abducted
Hands	Pronation(both)
Shoulders	Right is lower
Head position	Lateral flexion to the right Rotation to the right

Conclusion of posture evaluation

After posture evaluation it is shown that there is varocity in both knees, wide base of feet and external rotation of both hips which lead me to test Piriformis for shortening and to test Gluteus medius-minimus for strength. Plantar flexed ankles and hyperextented left knee lead me to test Gastrocnemius for weakness. Posterior pelvic tilt and flat lumbar spine lead me to test hamstrings for shortening and Rectus abdominus for weakness. Also the semi flexed right knee lead me to test strength of Quadriceps. Kyphosis of thoracic spine leads me to test weakness of Erector spinae.

3.2.2 Anthropometry

- Weight: 80 kg Right: 37 kg Left: 43 kg
- Height: 1,78 m

Table 4. Lower extremities

Anatomical length	Right: 91 cm Left 90 cm
Functional length	Right: 93 cm Left: 92 cm
Length of thigh	52 cm (both sides)
Length of middle leg	38 cm (both sides)
Length of foot	Right: 25 cm Left: 24 cm
Circumference of thigh	Right: 52 cm Left: 54 cm
Circumference of knee	Right: 44 cm Left: 41 cm

Circumference of ankle	27 cm (both sides)
Circumference of calf	Right: 40 cm Left: 42 cm
Circumference of foot	24 cm (both sides)

Table 5. Upper extremities

Length of humerus	29 cm (both sides)
Length of forearm	26 cm (both sides)
Circumference of biceps	35 cm (both sides)
Circumference of forearm	31 cm (both sides)

Conclusion of anthropometry

I think that after evaluation of anthropometry the results are normal. The length measurement of lower extremities is with 1 cm difference (left is longer) which I think that is from the edema and the dysfunction of muscles of the right (operated) leg which restricts the patient to fully extend his knee. Circumference measurement also is different by 1-2 cm which probably occurs that the muscles of right (operated) leg function less than the left leg muscles so they have lost some of their mass.

3.2.3 Gait evaluation

Doctor instructed the patient to walk with crunches so no load on the operated leg would occur. Evaluation was made at walking with crunches. Patient was walking already with crunches for 1 month so he got used of them and was walking correctly as follows:

1. Crunches.
2. Operated leg.
3. Non operated leg.

3.2.4 Examination of basic moving patterns (according to Janda)

Hip extension: Negative in both sides.

Patient performed the movement correctly with activation of gluteus maximus, hamstrings, contra lateral, par vertebral muscles of lumbar spine, ipsilateral par vertebral muscles of lumbar spine, contra lateral par vertebral muscles of thoracic spine.

Hip abduction: Positive in both sides.

Patient performed the movement with activation first of tensor fascia latae and then gluteus medius-minimus, quadratus lumborum.

Conclusion of basic moving patterns

Although hip extension was correctly executed hip abduction was faulty, patient started with flexion of hip joint and then abduction which leads me to test tensor fascia latae for shortening and also examine strength of gluteus medius-minimus.

3.2.5 Goniometry (according to Kendall)

Table 6. Hip joint

Right	Active	Left	Right	Passive	Left
-	**Hip joint**	-	-	**Hip joint**	-
10^0	Extension	10^0	10^0	Extension	10^0
90^0	Flexion	100^0	100^0	Flexion	115^0
38^0	Abduction	40^0	45^0	Abduction	45^0
8^0	Adduction	8^0	10^0	Adduction	10^0
25^0	Internal rotation	30^0	30^0	Internal rotation	35^0
35^0	External rotation	40^0	40^0	External rotation	45^0

Table 7. Knee Joint

Right	Active	Left	Right	Passive	Left
-15^0	Extension	0^0	-10^0	Extension	0^0
100^0	Flexion	130^0	110^0	Flexion	140^0

Table 8. Ankle joint

Right	Active	Left	Right	Passive	Left
40^0	Plantar flexion	40^0	45^0	Plantar flexion	45^0
15^0	Dorsal flexion	15^0	20^0	Dorsal flexion	20^0

Table 9. Foot

Right	Active	Left	Right	Passive	Left
35^0	Inversion	35^0	40^0	Inversion	40^0
15^0	Eversion	15^0	20^0	Eversion	20^0

Conclusion of Goniometry examination

After Goniometry examination it is obvious that there is decreased range of motion at the affected area (right side). During passive testing of ROM patient felt pain during knee flexion and knee extension at operated side. Mostly we can see restriction in the movements of knee flexion, knee extension, hip flexion and hip internal rotation but generally limited ROM exists in all joints of right leg. The restriction may be due to muscles dysbalance or weakening, or it could be from the edema restricting the movement, it can also happen cause of blockage in some joints. I should test strength of muscles controlling these movements (quadriceps, hamstrings, tensor fasciae latae, iliopsoas, and gluteus medius-minimus). Also I should test the Joint play of knee and ankle joint.

3.2.6 Muscle strength test (according to Kendall)

Table 10. Muscle strength test

Right	Muscle	Left
5	Tibialis anterior	5
4	Gastrocnemius	4
4	Soleus	5
4	Hamstrings	5
3	Quadriceps	4
3+	Gluteus medius	4
4	Gluteus minimus	4
4	Iliopsoas	4
5	Tensor fasciae latae	5
5	Sartorius	5
5	Piriformis	5
5	Gluteus maximus	5
4	Hip adductors	5
5	Rectus abdominis	5
4	Erector spinae	4

Conclusion of muscle strength test

Weakness found at muscles Gastrocnemius, Quadriceps (Rectus femoris, vastus lateralis, vastus medialis, vastus intermedius), hamstrings, gluteus medius, gluteus minimus, iliopsoas and hip adductors (pectineus, adductor magnus, gracilis, adductor brevis, adductor longus)

3.2.7 Muscle shortening test (according to Janda)

Table 11. Muscle shortening tests

Right	Muscle	Left
0	Gastrocnemius	0
0	Soleus	0
0	Hip adductors	0
2	Piriformis	2
0	Iliopsoas	0
1	Sartorius	1
0	Rectus femoris	0
1	Hamstrings	1
1	Tensor fasciae latae	1
0	Erector spinae	0

Conclusion of shortening examination

Shortening was found in muscles: Piriformis, Hamstrings, Sartorius and Tensor fasciae latae.

3.2.8 Palpation examination

Table 12. Palpation examination

Right	Muscle	Left
Hypertonus, painful, trigger points	Piriformis	Hypertonus, painful, trigger points
Hypertonus, painful, trigger points	Hamstrings	Hypertonus
Normal tonus	Tensor fasciae latae	Normal tonus
Hypotonus	Quadriceps	Normal tonus

Normal tonus	Iliopsoas	Normal tonus
Normal tonus	Sartorius	Normal tonus
Normal tonus	Gluteus maximus	Normal tonus
Hypotonus	Gluteus medius	Hypotonus
Hypotonus	Gluteus minimus	Hypotonus
Normal tonus	Rectus abdominis	Normal tonus
Normal tonus	Gastrocnemius	Normal tonus
Hypotonus	Erector spinae	Hypotonus

Conclusion of palpation examination

At palpation hypertonus and Trigger points were found at muscles: Piriformis (both sides) and Hamstrings (right side). Hypotonus was found at muscles: Quadriceps (right side), Gluteus medius (both sides), Gluteus minimus (both sides) and Erector spinae. Palpation for Piriformis and Hamstrings was painful for the patient.

Scar tissue evaluation:

Scar looks good. Its 12 cm long and little pink but looks that is healing nice. There is no pain during palpation. There is no restriction at any direction.

3.2.9 Joint play examination

Patella examination:

- In right patella there is restriction in medial and also in lateral direction. There is no restriction in caudal and cranial direction.
- In left patella there is no restriction in any direction.

Tibiofibular examination

- In right tibiofibular joint there is no restriction in any direction.
- In left tibiofibular joint there is no restriction in any direction.

Tibiofemoral examination

- In right tibiofemoral joint there is no restriction in any direction.
- In left tibiofemoral joint there is no restriction in any direction.

Lisfranc's joint

- In right Lisfranc joint there is no restriction in any direction
- In left Lisfranc joint there is no restriction in any direction

Chopart joint

- In right chopart joint there is no restriction in any direction
- In left chopart joint there is no restriction in any direction

Talocrular joint

- In right talocrular joint there is no restriction in any direction
- In left talocrular joint there is no restriction in any direction

Conclusion of Joint play examination

Restriction was found at Patella (right side) in medial and lateral direction. No restriction in other joints of the leg. Patient didn't feel pain during examination.

3.2.10 Conclusion of kinesiologic examination

Patient has edema in right (operated) knee. From posture evaluation the most significant findings were external rotation of hip joint, varosity of both knees and posterior tilt of pelvis. Gait evaluation was not examined because the patient could not load the operated leg and had to walk with the aid of crunches. Pathological sign was found at Basic stereotype movement of hip abduction, patient performed it with flexion of the hip. Restriction of ROM was found almost in all joints of the operated leg, most important in knee flexion and extension but also in hip internal-external rotation. After strength test weakness was found primary at muscles Quadriceps and Gluteus medius but also at muscles hamstrings Gluteus minimus, gastrocnemius, soleus and hip adductors. Shortening was found at muscles Piriformis, Sartorius, Hamstrings and Tensor fasciae latae. At palpation examination hypertonus and Trigger points were found at muscles piriformis and hamstrings. Hypotonus was found at muscles Quadriceps, Gluteus medius-minimus and Erector spinae. Blockage of patella in medial and lateral direction was found after Joint play examination.

3.2.11 Therapy proposal

After all the information that i have from the examination I will try to focus first of all to decrease the edema which I think is restricting most of the movements. Patient is a footballer so generally he is strong but because for more than a month he does not any training or physical activities except swimming exercises in the hospital some of the muscles have lost power and we must regain it. Patient feels pain mostly during extension of the knee and little pain during flexion. There is restriction at patella of the right knee. So my approach will be soft tissue techniques for edema and scar tissue, strengthening exercises for

weak muscles, muscle resistance technique (MRT) for trigger points, shortened muscles and hyper tonus muscles and also mobilization for Patella. When patient gains power and can load his operated leg I will start with sensory motor stimulation for better stability of the knee. For long term I would like to correct patient's faulty posture.

3.3 Short-term and long-term rehabilitation plan

Short-term

- Decrease edema
- Soft tissue technique for scar
- Strengthen weak muscles
- Relax shortened or hyper tonus muscles
- Remove blockage from right patella
- Instruction for walking on crunches
- Improve range of motion of restricted joints
- Sensory motor stimulation

Long-term

- Correct faulty posture
- Correct breathing pattern
- Improve gait (when he remove crunches)
- Improve sitting posture
- Improve coordination of muscles

3.4 Rehabilitation of physiotherapy

First session (11-2-09)

- Initial Kinesiologic examination

Today I did the first kinesiological examination and I will continue with the therapy focusing on decreasing the edema and continue on strengthening exercises for weak muscles and relaxation techniques for shortened muscles.

Goals for today: Decrease edema, strengthening of weak muscles

- Condition exercises for warm-up (active movements of upper and lower extremities, flexion, extension and rotational movements)
- Soft tissue techniques of scar for 10 minutes.

  Procedure:

  A) With my medial aspects of thumb I press the scar from lateral and medial side and connect the tissue

  B) Creating a fold with my thumbs and press

  C) With one thumb pressing the scar at 1-2 cm for 2-3 seconds and then next 1-2 cm until whole scar is covered.
- Soft tissue techniques for edema: massage with cream for 10 minutes
- Strengthening exercises with over ball:

Over ball under foot: Patient is sitting and the over ball is placed under the foot and patient is instructed to press the ball down to the floor. Exercise for quadriceps strengthening. 2 sets of 10 repetitions.

Over ball between knees: Patient is side lying and over ball is placed between knees. Patient is instructed to press the ball between his knees. Exercise for hip adductors. 2 sets of 10 repetitions each.

Rolling over ball: Patient is supine, over ball is placed under his foot. Patient is performing hip and knee flexion rolling the ball to his buttocks. Exercise for hamstrings strengthening. 2 set 10 repetitions.

- Active abduction: Patient is side lying and is asked to lift his leg toward the roof. Exercise for hip abductors (Gluteus medius-minimus). 2 sets, 10 repetitions.
- Post facilitation stretch (PFS) for Tensor fasciae latae. Muscle is placed not fully stretched but almost stretched. Then the patient is told to put resistance to therapist's hand with maximum effort for 8 seconds. After patient is told "breath in" and "breath out" and "relax". Therapist provides a quick stretch of the muscle to the end point and holds it there for 20 seconds allowing the patient to relax. Repeated 3 times.

  Procedure for Tensor Fasciae Latae: Patient is supine. Non operated leg is at flexion and adduction of the hip and flexion of the knee, foot is on the table. Operated leg is at adduction of the hip and extension of the knee and outside of the table. Therapist is standing and with his thigh on patient's lateral maleolus. Patient's movement is to abduction and the technique is performed as described above. Repeated 3 times.
- Post isometric relaxation (PIR) for Piriformis, Hamstrings. It's Similar to PFS but patient put less effort. Muscle is passively stretched to the point of barrier. Having the patient isometrically contract but with gentle force against therapist's hand for 8 seconds. After patient is told "breath in" and "breath out" and "relax". When patient is relaxing therapist passively lengthen the muscle as much as relaxation allows. PIR repeated 3 times.

  Procedure for Piriformis: Patient is prone. Leg is in internal rotation of the hip and flexion of the knee to 90^0. Therapist is standing and with his one hand fixes lumbar spine and with his other hand touches patient's foot at medial maleolus. Patient's movement is to external rotation and the technique is peformed as described above. Repeated 3 times.

  Procedure for Hamstrings: Patient is supine. Leg in flexion of the hip and extension of the knee. Therapist is standing and patient's foot is on therapist's shoulder. Patent's movement is to extension of hip and the technique is performed as above. Repeated 3 times.
- Stretching for Sartorius.

- Teaching patient to walk correctly with crunches: Patient is instructed to move crunches then move operated leg and then healthy leg. He must not bend his body so no thoracic kyphosis occur and also no lumbar lordosis must occur. Patient must walk with crunches in straight posture.

Second session (12-2-09)

Subjective finding: Patient feels fine today, slept without problem, only problem that he has to sleep supine all night.
Objective finding: Edema is still red and quite big, scar looks good. Shortening remains in Tensor fasciae latae, Sartorius and Trigger points in Hamstrings and Piriformis.

Goals of today: Decrease edema, strengthening of weak muscles, relaxation of shortening muscles, mobilization of restricted joints.

- Condition exercises for warm-up (active movements of upper and lower extremities, flexion, extension and rotational movements)
- Soft tissue techniques of scar for 10 minutes as last session.
- Soft tissue techniques for edema: massage with cream for 10 minutes.
- Strengthening exercises with over ball as last session.
- Active abduction: Patient is side lying and is asked to lift his leg toward the roof. Exercise for hip abductors (Gluteus medius-minimus). 2 sets, 10 repetitions.
- PFS for Tensor fasciae latae as last session.
- PIR for Piriformis, Hamstrings as last session.
- Stretching for Sartorius.
- Mobilization of right patella in medial and lateral direction.
  Procedure: For medial direction therapist's both thumbs placed on lateral side of patella and second and third fingers on the medial side. Barrier is

reached by movements of thumbs to the medial direction and then repeated movements by thumbs are performed for mobilization.
For lateral direction the manual contact is the same but the movement is performed from second and third fingers to lateral direction.

- Teaching patient to walk correctly with crunches.

Third session (13-2-09)

Subjective finding: Patient feels better after last therapy, he has no complains about pain.

Objective finding: Edema today is not so red, I think soft tissue technique helps, also I am happy to see that ROM in knee flexion gained 5^0 so I will continue with the same approach.

Goals of today: Decrease edema, strengthening of weak muscles, relaxation of shortening muscles, mobilization of restricted joints.

- Condition exercises for warm-up (active movements of upper and lower extremities, flexion, extension and rotational movements)
- Soft tissue techniques of scar for 10 minutes as last session.
- Soft tissue techniques for edema: massage with cream for 10 minutes.
- Strengthening exercises with over ball
- Active abduction: Patient is side lying and is asked to lift his leg toward the roof. Exercise for hip abductors (Gluteus medius-minimus). 2 sets, 10 repetitions.
- PFS for Tensor fasciae latae as last session.
- PIR for Piriformis, Hamstrings as last session.
- Stretching for Sartorius.
- Mobilization of right patella in medial and lateral direction
- Teaching patient to walk correctly with crunches.

Fourth session (16-2-09)

Subjective finding: Patient feels much better today, I saw him coming currying his crunches but it was obvious that he couldn't walk so I told him that is important to use them and still not load the leg.

Objective finding: Edema is decreased due to soft tissue technique therapy, Sartorius shortening is eliminated but I better continue with stretching for better results. Mobilization for patella seems to work since I feel less restriction in my hands so I will continue like this.

Goals of today: Decrease edema, strengthening of weak muscles, relaxation of shortening muscles, mobilization of restricted joints.

- Condition exercises for warm-up (active movements of upper and lower extremities, flexion, extension and rotational movements)
- Soft tissue techniques of scar for 10 minutes as last session.
- Soft tissue techniques for edema: massage with cream for 10 minutes.
- Strengthening exercises with over ball
- Active abduction: Patient is side lying and is asked to lift his leg toward the roof. Exercise for hip abductors (Gluteus medius-minimus). 2 sets, 10 repetitions.
- PFS for Tensor fasciae latae as last session.
- PIR for Piriformis, Hamstrings as last session.
- Stretching for Sartorius.
- Mobilization of right patella in medial and lateral direction
- PNF, lower extremities, 1^{st} diagonal extension, Rhythmic stabilization technique (strengthening gluteus medius-minimus, gastrocnemius, soleus)

  Procedure: Patient supine, toes in extension, abduction, ankle in dorsal flexion and inversion, knee in flexion, hip in flexion, adduction and

internal rotation. The manual contact was with the same hand to the lateral aspect of plantar surface of foot and toes and with the opposite hand on the posterolateral aspect of thigh. The technique rhythmic stabilization was performed by isotonic contraction of agonistic pattern to the point of weakness then isometric against resistance of both antagonistic and agonistic pattern. And then isotonic against resistance of agonistic pattern.

- Teaching patient to walk correctly with crunches.

Fifth session (17-2-09)

Subjective finding: Patient feels good. He tells me that he didn't sleep very good last night because of pain in the operated leg but when he woke up the pain was gone.

Objective finding: It seems that over ball exercises in addition with PNF helped, abduction stereotype seems improved and also he gained 5^0 in flexion and extension of the knee. I will add Thera band exercises in the program for better results. I can see that restriction of patella is almost eliminated so I will continue like this.

Goals of today: Decrease edema, strengthening of weak muscles, relaxation of shortening muscles, mobilization of restricted joints.

- Condition exercises for warm-up (active movements of upper and lower extremities, flexion, extension and rotational movements)
- Soft tissue techniques of scar for 10 minutes as last session.
- Soft tissue techniques for edema: massage with cream for 10 minutes.
- Strengthening exercises with over ball as last session.
- Active abduction: Patient is side lying and is asked to lift his leg toward the roof. Exercise for hip abductors (Gluteus medius-minimus). 2 sets, 10 repetitions.

- Strengthening exercises with Thera band for quadriceps muscles and Gluteus medius-minimus:

  Thera band knee extension: Patient is sitting and Thera band is tied one end on his ankle and other and on the foot of the bed, he does extension of the knee. 2sets, 10 repetitions.

  Thera band hip abduction: Patient is side lying and Thera band is tied around his both ankles. Patients does abduction of the leg. 2 sets, 10 repetitions.

  Thera band hip flexion: Patient is sitting, Thera band is tied around his operated knee and the other end is under the other foot, patient is doing flexion of the hip. 2 sets, 10 repetitions each
- PNF, lower extremities, 1st diagonal extension, Rhythmic stabilization technique
- PFS for Tensor fasciae latae as last session.
- PIR for Piriformis, Hamstrings as last session.
- Stretching for Sartorius.
- Mobilization of right patella in medial and lateral direction
- Teaching patient to walk correctly with crunches.

Sixth session (18-2-09)

Subjective finding: Patient feels fine. He slept well and he had no complains about pain.

Objective finding: Edema is decreased and it's not red anymore but quite pink and as edema is decreased ROM is increased, above all this, he provided hip abduction stereotype correct. Today I will start sensory motor stimulation for better stability of the knee.

Goals of today: Decrease edema, strengthening of weak muscles, relaxation of shortening muscles, mobilization of restricted joints, sensory motor stimulation.

- Condition exercises for warm-up (active movements of upper and lower extremities, flexion, extension and rotational movements)
- Soft tissue techniques of scar for 10 minutes as last session.
- Soft tissue techniques for edema: massage with cream for 10 minutes.
- Strengthening exercises with over ball
- Active abduction: Patient is side lying and is asked to lift his leg toward the roof. Exercise for hip abductors (Gluteus medius-minimus). 2 sets, 10 repetitions.
- Strengthening exercises with Thera band for Quadriceps muscles, Gluteus medius-minimus and Iliopsoas
- PNF, lower extremities, 1st diagonal extension, Rhythmic stabilization technique.
- PFS for Tensor fasciae latae as last session.
- PIR for Piriformis, Hamstrings as last session.
- Stretching for Sartorius.
- Mobilization of right patella in medial and lateral direction
- Sensory motor stimulation of right foot:

I showed the patient how to perform the "short foot" in sitting position passively and after he did it actively.

Procedure: Patient is sitting, I am doing short foot passively, narrowing of the foot, then I tell him to do it with me semi active and tell him to relax the toes as much as he can. After this he performs it actively.

Seventh session (19-2-09)

Subjective finding: Patient feels great, he tells me that he feels his leg moving "more easy" but he again came carrying his crunches and told him that he still have to use them as doctor instructed.

Objective finding: Edema is almost eliminated and ROM is increased much. Restriction of patella eliminated due to mobilization and hip abduction

stereotype is performed correctly without flexion, internal or external rotation. Also shortening form Sartorius and Tensor fasciae latae is removed.

Goals of today: Decrease edema, strengthening of weak muscles, relaxation of shortening muscles, mobilization of restricted joints, sensory motor stimulation.

- Condition exercises for warm-up (active movements of upper and lower extremities, flexion, extension and rotational movements)
- Soft tissue techniques of scar for 10 minutes as last session.
- Soft tissue techniques for edema: massage with cream for 10 minutes.
- Strengthening exercises with over ball
- Active abduction: Patient is side lying and is asked to lift his leg toward the roof. Exercise for hip abductors (gluteus medius-minimus). 2 sets, 10 repetitions.
- Strengthening exercises with Thera band for quadriceps muscles, Gluteus medius-minimus and iliopsoas.
- PNF, lower extremities, 1st diagonal extension, Rhythmic stabilization technique.
- PFS for tensor fasciae latae as last session.
- PIR for Piriformis, Hamstrings as last session.
- Stretching for Sartorius.
- Mobilization of right patella in medial and lateral direction
- Sensory motor stimulation of right foot:

Today we continue from we left yesterday, patient already knows how to perform "short foot" sitting so we continue on standing. I put him in the correct posture, semi flexion of knees, feet parallel and slight apart, and body straight. I advise him to the correct posture and tell him to sway back and forward but with the heels fixed on the ground. After this he performs the "half step forward stance". I tell him to provide a half step forward and then I gently push him on chest and trunk and advise him to keep his balance.

Eighth session (20-2-09)

Subjective finding: Patient is very happy as he feels much stronger and without any pain.

Objective finding: Edema is removed and weak muscles got stronger. Trigger points from piriformis and hamstrings are removed. ROM in knee flexion is almost 20^0 increased and knee extension 10^0.

Goals of today: Strengthening of weak muscles, relaxation of shortening muscles, mobilization of restricted joints, sensory motor stimulation.

- Condition exercises for warm-up (active movements of upper and lower extremities, flexion, extension and rotational movements)
- Soft tissue techniques of scar for 10 minutes as last session.
- Soft tissue techniques for edema: massage with cream for 10 minutes.
- Strengthening exercises with over ball
- Active abduction: Patient is side lying and is asked to lift his leg toward the roof. Exercise for hip abductors (gluteus medius-minimus). 2 sets, 10 repetitions.
- Strengthening exercises with Thera band for quadriceps muscles, gluteus medius-minimus and iliopsoas :
- Thera band knee extension: Patient is sitting and Thera band is tied one end on his ankle and other and on the foot of the bed, he does extension of the knee. 2sets, 10 repetitions.
- Thera band hip abduction: Patient is side lying and Thera band is tied around his both ankles. Patients does abduction of the leg. 2 sets, 10 repetitions.
- Thera band hip flexion: Patient is sitting, Thera band is tied around his operated knee and the other end is under the other foot, patient is doing flexion of the hip. 2 sets, 10 repetitions each.

- PNF, lower extremities, 1st diagonal extension, Rhythmic stabilization technique.
- PFS for Tensor fasciae latae as last session.
- PIR for Piriformis, Hamstrings as last session.
- Stretching for Sartorius.
- Mobilization of right patella in medial and lateral direction
- Sensory motor stimulation of right foot:

Patient start exercises on the rocker board. He tries to maintain his balance and the "short foot" on the rocker board while I push him gently on the buttocks, chest and back and tell him to keep his heels on the rocker board.

- Final kinesiologic examination

3.5 Final kinesiologic examination

3.5.1 Posture evaluation

Table 13. Frontal view

Transversal arch	Flat (both feet)
Longitudinal arch	Normal (both feet)
Feet	External rotation (both feet)
Calf	Symmetrical
Knee Patella	Varosity (both sides) Normal (both knees) **improved**
Thigh contour	Symmetrical
Anterior superior iliac spines	Symmetrical
Umbilicus	Middle line
Nipples	Right is lower

Hands	Pronation (both hands)
Clavicles	Right is lower
Shoulders	Right is lower(dominant hand is right)
Head position	Lateral flexion to the right Rotation to the right

Breathing type:

Upper chest breathing.

Table 14. Side view

Ankle joints	Plantar flexion(both sides)
Knee joints	Right in normal position (edema is decreased) **improved** Left in normal position **improved**
Pelvis position	Posterior tilt
Lumbar spine	Flat
Thoracic spine	Flexed (kyphosis)
Cervical spine	Slight extension
Head position	Protraction

Table 15. Posterior view

Heel form	Square shape (both sides)
Achilles tendon contour	Symmetrical
Base of feet	Wide base
Calf	Symmetrical (both sides)
Knee joints	Varosity (both sides)

Subgluteal lines	Symmetrical
Iliac crests	Symmetrical
Posterior superior iliac spines	Symmetrical
Scapulas	Right scapula is abducted
Hands	Pronation (both)
Shoulders	Right is lower
Head position	Lateral flexion to the right Rotation to the right

3.5.2 Anthropometry

- Weight: 80 kg Right: 39 kg Left: 41 kg
- Height: 1,78 m

Table 16. Lower extremities

Anatomical length	Right: 91 cm Left 90 cm
Functional length	Right: 93 cm Left: 92 cm
Length of thigh	52 cm (both sides)
Length of middle leg	38 cm (both sides)
Length of foot	Right: 25 cm Left: 24 cm
Circumference of thigh	Right: 53 cm Left: 54 cm
Circumference of knee	Right: 42 cm **improved** Left: 41 cm
Circumference of ankle	27 cm (both sides)

Circumference of calf	Right: 40 cm Left: 42 cm
Circumference of foot	24 cm (both sides)

Table 17. Upper extremities

Length of humerus	29 cm (both sides)
Length of forearm	26 cm (both sides)
Circumference of biceps	35 cm (both sides)
Circumference of forearm	31 cm (both sides)

3.5.3 Examination of basic moving patterns (according to Janda)

Hip extension: Negative in both sides.

Patient performed the movement correctly with activation of Gluteus maximus, Hamstrings, contra lateral, par vertebral muscles of lumbar spine, ipsilateral par vertebral muscles of lumbar spine, contra lateral par vertebral muscles of thoracic spine.

Hip abduction: Negative in both sides. **(Improved)**

Patient performed the movement with activation of Gluteus medius-minimus then Tensor fasciae late and then Quadratus lumborum

3.5.4 Goniometry (according to Kendall)

Table 18. Hip joint

Right	**Active**	**Left**	**Right**	**Passive**	**Left**
-	**Hip joint**	-	-	**Hip joint**	-
10^0	Extension	10^0	10^0	Extension	10^0
120^0	Flexion	120^0	125^0	Flexion	125^0

(improved)		**(improved)**			
45^0 **(improved)**	Abduction	45^0 **(improved)**	45^0	Abduction	45^0
10^0 **(improved)**	Adduction	10^0 **(improved)**	10^0	Adduction	10^0
35^0 **(improved)**	Internal rotation	35^0 **(improved)**	40^0	Internal rotation	40^0
40^0 **(improved)**	External rotation	45^0 **(improved)**	45^0	External rotation	45^0

Table 19. Knee Joint

Right	**Active**	**Left**	**Right**	**Passive**	**Left**
-5^0 **(improved)**	Extension	0^0	-7^0	Extension	0^0
120^0 **(improved)**	Flexion	140^0 **(improved)**	125^0	Flexion	140^0

Table 20. Ankle joint

Right	**Active**	**Left**	**Right**	**Passive**	**Left**
45^0 **(improved)**	Plantar flexion	45^0 **(improved)**	45^0	Plantar flexion	45^0
15^0	Dorsal flexion	15^0	20^0	Dorsal flexion	20^0

Table 21. Foot

Right	Active	Left	Right	Passive	Left
35^0	Inversion	35^0	40^0	Inversion	40^0
15^0	Eversion	15^0	20^0	Eversion	20^0

3.5.5 Muscle strength test (according to Kendall)

Table 22. Muscle strength test

Right	Muscle	Left
5	Tibialis anterior	5
4+ **(improved)**	Gastrocnemius	4+ **(improved)**
4+ **(improved)**	Soleus	5
5 **(improved)**	Hamstrings	5
4+ **(improved)**	Quadriceps	4+ **(improved)**
4+ **(improved)**	Gluteus medius	5 **(improved)**
5 **(improved)**	Gluteus minimus	5 **(improved)**
5 **(improved)**	Iliopsoas	4+ **(improved)**
5	Sartorius	5
5	Tensor fasciae latae	5

5	Piriformis	5
5	Gluteus maximus	5
5 **(improved)**	Hip adductors	5
5	Rectus abdominis	5
4	Erector spinae	4

3.5.6 Muscle shortening test (according to Janda)

Table 23. Muscle shortening tests

Right	Muscle	Left
0	Gastrocnemius	0
0	Soleus	0
0	Hip adductors	0
0 **(improved)**	Piriformis	1 **(improved)**
0	Iliopsoas	0
0 **(improved)**	Sartorius	0 **(improved)**
0	Rectus femoris	0
0 **(improved)**	Hamstrings	0 **(improved)**
0 **(improved)**	Tensor fasciae latae	0 **(improved)**
0	Erector spinae	0

3.5.7Palpation examination

Table 24. Palpation examination

Right	Muscle	Left
Normal tonus **(improved)**	Piriformis	Normal tonus **(improved)**
Normal tonus **(improved)**	Hamstrings	Normal tonus **(improved)**
Normal tonus	Tensor fasciae latae	Normal tonus
Normal tonus **(improved)**	Quadriceps	Normal tonus
Normal tonus	Iliopsoas	Normal tonus
Normal tonus	Sartorius	Normal tonus
Normal tonus	Gluteus maximus	Normal tonus
Normal tonus **(improved)**	Gluteus medius	Normal tonus **(improved)**
Normal tonus **(improved)**	Gluteus minimus	Normal tonus **(improved)**
Normal tonus	Rectus abdominis	Normal tonus
Normal tonus	Gastrocnemius	Normal tonus
Hypotonus	Erector spinae	Hypotonus

3.5.8 Joint play examination

Patella examination **(improved)**:

- In right patella there is no restriction in any direction.
- In left patella there is no restriction in any direction.

3.5.9 Therapy effect

After 8 sessions with the patient the improvement was significant, first of all the edema was decreased and almost eliminated, weak muscles got stronger and shortened or hypertonus muscles were relaxed. Restriction of patella was removed after mobilization. Posture improved especially in the lower extremities which I focused on. Also range of motion increased. Patient now can load the operated leg and walk without crunches but the instructions from the doctor was to walk with crunches for 1 week more. He has no pain at all and has no problem performing activities of daily living.

3.6 Prognosis

Prognosis looks good, the patient is footballer so he is strong, even before the therapy started at the first kinesiologic examination most of his muscles were strong, he is determined to get back to training so he did everything that I was telling him to do and we had no problem in working together. Patients with chondrotissue operation generally needs 6 months to get back to the state they were before but my opinion is that the patient will be ready to go to training much sooner. If he continues exercises and the instructions that doctor and I gave him then he will have no problem in the future. He also does a lot of swimming exercises at UVN and this will help him a lot.

4. Conclusion

The 2 weeks that I had my practice in Vojenska Nemocnice were really helpful for me, I tried to use most of the techniques that I have learned in FTVS and I couldn't wish for better patient, he helped a lot with his will to get better fast and he was doing every exercise without discomfort, every day he was telling me that he feels even better than the previous, sometimes he was coming to the hospital carrying the crunches on his hand and I had to tell him that he must use them to walk cause that was the doctor's instructions. His willingness made me tried even harder to help him get better. I think that the task and the goals of this bachelor thesis were accomplished and I am happy about it. Knee problems are very common in the world and it was good that I had the chance to work with a diagnosis like this because it will surely help me in the future. Also my supervisor there, Dis Jindriska Sverakova was always beside me when I had a problem and she helped me a lot.

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List of abbreviations

1) ROM: Range of Motion

2) PFS: Post Facilitation Stretch

3) PIR: Post Isometric Relaxation

4) OA: Osteoarthritis

5) MRT: Muscle Resistance Technique

6) MCL: Medial Collateral Ligament

7) LCC: Lateral Collateral Ligament

8) ACL: Anterior Cruciate Ligament

9) PCL: Posterior Cruciate Ligament

10) PNF: Proprioreceptive Neuromuscular Facilitation

11) ADL: Activities of Daily Living

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Application for Ethics Board Review

of the research project, undergraduate research, involving human subjects

Project title: Therapeutic Approach in Gonarthrosis

Nature of the research project: basic research / undergraduate research

Author (chief investigator): **Spyrellis Charilaos**

Supervisor (in case of student research): Doc. PaedDr. Dagmar Pavlů, CSc.

Case study of the physiotherapy of the patient with diagnosis: Gonarthrosis
will be processed with supervision of skilled physiotherapist in: ÚVN (Ústřední vojenská nemocnice) Praha
No invasive method will be used. Personal datas will be not published.
Informed consent (in Czech Language attached)

Date: 18. February 2009 Author's signature: [signature]

Faculty of Physical Education and Sport, Charles University in Prague
ETHICS BOARD REVIEW

Ethics Board members: Doc. MUDr. Staša Bartůňková, CSc.
Prof. Ing. Václav Bunc, CSc.
Prof. PhDr. Pavel Slepička, DrSc.
Doc. MUDr. Jan Heller, CSc.

The Ethics Board at the Faculty of Physical Education and Sport, Charles University, approved the research project.
Approval number: 0294/2009
Date: 6.4.2009

The Ethics Board at the Faculty of Physical Education and Sport, Charles University, reviewed the submitted research project and **found no contradictions with valid principles**, regulations and international guidelines for biomedical research involving human subjects.

The chief investigator of the project met the necessary requirements for receiving the Ethics Board approval.

Official school stamp

[signature]
Signature, REB Chairman